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TITLE: **Call distribution** for a radio exchange station in a **mobile** communication system

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Abstract Text - ABTX (1):

In a radio exchanging station comprising a selection **processing** execution **processor** and first through N-th **call processing** execution **processors,** an n-th **call processing** execution **processor** (1.ltoreq.n.ltoreq.N) periodically delivers, to the selection **processing** execution **processor,** an n-th use condition signal indicative of an n-th use condition of an n-th radio resource managed by the n-th **call processing** execution **processor** and an n-th **load** condition signal indicative of an n-th **load** condition of the n-th **call processing** execution **processor**. On the basis of first through N-th use conditions and first through N-th **load** conditions, the selection **processing** execution **processor** determines first through N-th **call** reception permissible numbers for **distributing** to the first through the N-th **call processing** execution **processors,** respectively.

US Patent No. - PN (1):

6643514

TITLE - TI (1):

Call distribution for a radio exchange station in a **mobile** communication system

Brief Summary Text - BSTX (2):

This invention relates to a radio exchanging station carrying out a **call** control in a plurality of **processors** and, more particularly, to a **call distributing** method for carrying out **distribution** for traffic of the radio exchanging station to avoid a congestion state in each **processor**.

Brief Summary Text - BSTX (3):

A conventional radio exchanging station comprises a plurality of **call** control **processors and a call** control monitoring **processor**. The **call** control monitoring **processor is called** a congestion control **processor**. In a case where the radio exchanging station carries out **call** control for the **call** control **processors, a call distribution** method is carried out as follows. That is, the **call** control monitoring **processor** (the congestion control **processor**) monitors congestion states of the respective **call** control **processors**. When a particular **call** control **processor** is put into the congestion state, a request of the **call** control from the **call** control monitoring **processor** to the particular **call** control **processor** is regulated. Accordingly, the conventional **call distributing** method is disadvantageous in that **call distribution to the call** control **processor** in question increases and it results in adversely effecting

other call control processors. Accordingly, the conventional radio exchanging station may carry out an unstable call control.

Brief Summary Text - BSTX (4):

Various prior arts related to this invention are already known. By way of example, Japanese Unexamined Patent Publication (JP-A) of Tokkai No. Hei 7-298,340 or JP-A 7-298340 discloses a mobile communication system and a mobile station, which are capable of enabling first through fourth items, i.e., the setting of whether a speech channel is switched or not by a mobile station user, the early detection of an illegal mobile station, the avoidance of convergence of call control processing at a base station control station, and the avoidance of convergence of a simultaneous call channel. According to JP-A 7-298340, for the first item, a mobile station is provided with an arrangement which informs a user that a speech channel switching factor is detected on a mobile network side and a switch which enables the user to select whether a telephone call can be selected, thereby enabling the intention of the user to be transmitted to the network side. For the second item, the cumulative telephone charge is totalized individually on the network side and mobile station side and compared with each other to find the illegal mobile station. For the third item, the number of base stations controlled by the base station control station is varied dynamically in real time according to the convergence state. For the fourth item, the number of radio zones constituting position registration areas is varied in real time according to the load state of call processing, etc., to places peripheral position registration areas in partial charge of a load.

Brief Summary Text - BSTX (5):

Japanese Unexamined Patent Publication (JP-A) of Tokkai No. Hei 8-287,032 or JP-A 8-287032 discloses a communication management system for multi-processor system, which is capable of reliving a congestion state by the mutual communication processing of a plurality of processors by providing each processor with a recognizing arrangement allowing the processor to recognize the congestion states of all processors. According to JP-A 8-287032, the communication management system is provided with a plurality of call processing processors for mainly controlling the exchange processing of a private branch exchange (PBX) and respective processors are mutually connected through communication lines so as to execute mutual communication. Each processor is provided with a recognizing arrangement allowing the processor to recognize the congestion states of all processors. The recognizing arrangement mutually transmits/receives congestion state information to/from recognizing arrangements in other processors through communication lines. Thereby each processor can recognize the congestion states of other processors, and when a certain processor in the system reaches a congestion state, the congestion state can be relieved by the mutual communication processing of respective processors before system transmission regulation is generated from a management processor.

Brief Summary Text - BSTX (6):

Japanese Unexamined Patent, Publication (JP-A) of Tokkai No. Hei 10-65,728 or JP-A 10-65728 discloses a distribution processor-type data exchange where the processing ability of a whole system is improved. According to JP-A 10-65728, the exchange is provided with a node control processor (NCP) and a plurality of line containing processors (LCP) for executing the routing processing of a call. The node control processor controls the utilizing ratio

of CPU of whole line containing **processors and the processor** number of the lowest CPU utilizing ratio is reported to whole line containing **processors** by multi-address communication. In the meantime, when a **processing** request is received, respective line containing **processors** shift the **processing to the processor** with the lower CPU utilizing ratio when the CPU utilizing ratio of itself is high.

Brief Summary Text - BSTX (7):

Japanese Unexamined Patent Publication (JP-A) of Tokkai No. Hei 5-89,055 or JP-A 5-89055 discloses a packet exchange control system in a multi **processor** system, which is capable of performing the control of a data transfer phase by a multi **processor** system in one **processor**. According to JP-A 5-89055, by the transmitting and receiving of a route selection information (including transmitting side information and master deciding information) signal from a transmitting side function block at the time of setting a **call** and a connection completion (including transmitting side control request and receiving side information) signal from a receiving side function block, the transmitting side is decided to be a master. Subsequently, by making possible the transmitting and receiving of a signal of slave side receiving side function block at the time of a data transfer phase and a transmitting side function block, the control of a data transmitting requesting signal from both transmitting side and receiving side is performed at the transmitting side function block (master side).

Brief Summary Text - BSTX (9):

It is therefore an object of this invention to provide a **call distribution** method which is capable of decreasing **distribution for call processing** execution **processors** in a selection **processing** execution **processor**.

Brief Summary Text - BSTX (10):

It is another object of this invention to provide a **call distribution** method of the type described, which has no adverse effect on other **call processing** execution **processors**.

Brief Summary Text - BSTX (11):

It is still another object of this invention to provide a **call distribution** method of the type described, which is capable of continuing a stable **call processing** operation.

Brief Summary Text - BSTX (13):

On describing the gist of an aspect of this invention, it is necessary to be understood that a method is for **distributing calls** in a radio exchanging station for use in a **mobile** communication system. The radio exchanging station comprises a selection **processing** execution **processor** and first through N-th **call processing** execution **processors**, where N represents a positive integer which is not less than two.

Brief Summary Text - BSTX (14):

According to the aspect of this invention, an n-th **call processing** execution **processor** periodically delivers, to the selection **processing** execution **processor**, an n-th use condition signal indicative of an n-th use condition of

an n-th radio resource managed by the n-th call processing execution processor and an n-th load condition signal indicative of an n-th load condition of the n-th call processing execution processor, where n represents each of 1 through N. On the basis of first through N-th use conditions and first through N-th load conditions, the selection processing execution processor determines first through N-th call reception permissible numbers for distributing to the first through the N-th call processing execution processors, respectively. In addition, the radio exchanging station may comprise only one call processing execution processor in lieu of a plurality of call processing execution stations.

Drawing Description Text - DRTX (2):
FIG. 1 is a block diagram of a radio exchanging station for use in a mobile communication system to which a call distribution method according to an embodiment of this invention is applicable;

Drawing Description Text - DRTX (3):
FIG. 2 is a block diagram of a memory section in a selection processing execution processor for use in the radio exchanging station illustrated in FIG. 1;

Drawing Description Text - DRTX (4):
FIG. 3 is a flowchart for use in describing of operation of notification of an n-th use condition of an n-th radio resource managed by an n-th call processing execution processor for use in the radio exchanging station illustrated in FIG. 1;

Drawing Description Text - DRTX (5):
FIG. 4 is a flowchart for use in describing of operation of notification of a normal load state as an n-th load condition of the n-th call processing execution processor for use in the radio exchanging station illustrated in FIG. 1;

Drawing Description Text - DRTX (6):
FIG. 5 is a flowchart for use in describing of operation of notification of an overload state as the n-th load condition of the n-th call processing execution processor for use in the radio exchanging station illustrated in FIG. 1; and

Drawing Description Text - DRTX (7):
FIG. 6 is a flowchart for use in describing of operation of determining of a call control processor in the selection processing execution processor for use in the radio exchanging station illustrated in FIG. 1.

Detailed Description Text - DETX (2):
Referring to FIG. 1, the description will proceed to a call distributing method in a radio exchanging station 01 for use in a mobile communication system according to an embodiment of this invention. FIG. 1 is a block diagram of the radio exchanging station 01 in the mobile communication system to which the call distribution method according to the embodiment of this invention is

applicable. As illustrated in FIG. 1, the radio exchanging station 01 comprises a selection **processing** execution **processor** 10, first through N-th **call processing** execution **processors** 21, 22, . . . , and 2N which are connected to the selection **processing** execution **processor** 10, and first through N-th radio resources 31, 32, . . . , and 3N which are managed by the first through the N-th **call processing** execution **processors** 21 to 2N, respectively, where N represents a positive integer which is not less than two. In addition, the selection **processing** execution **processor** 10 comprises a program section 110 and a memory section 120.

Detailed Description Text - DETX (3):

Referring now to FIG. 1, the description will proceed to operation of the **call distributing** method according to the embodiment of this invention. An n-th **call processing** execution **processor** 2n periodically sends, to the selection **processing** execution **processor** 10, an n-th use condition signal indicative of an n-th use condition of an n-th radio resource 3n and an n-th **load** condition signal indicative of an n-th **load** condition of the n-th **call processing** execution **processor** 2n, where n represents each of 1 through N. On the basis of the first through the N-th use conditions and the first through the N-th **load** conditions, the selection **processing** execution **processor** 10 carries out **distribution of a call** in the manner which will later become clear.

Detailed Description Text - DETX (4):

Turning to FIG. 2, the memory section 120 comprises a use condition storing area 121, a **load** condition storing area 122, and a **call** reception permissible number storing area 123. The use condition storing area 121 stores the first through the N-th use conditions indicated by the first through the N-th use condition signals. The **load** condition storing area 122 stores the first through the N-th **load** conditions indicated by the first through the N-th **load** condition signals. The **call** reception permissible number storing area 123 stores first through N-th **call** reception permissible numbers for the first through the N-th **call processing** execution **processors** 21 to 2N, respectively. The first through the N-th **call** reception permissible numbers are **called** first through N-th **distribution** limitation values, respectively.

Detailed Description Text - DETX (5):

Referring now to FIGS. 3 through 6, the description will proceed to operation of the **call distribution** method of the radio exchanging station 01 in detail. FIG. 3 is a flowchart for use in describing of operation of notification of the n-th use condition of the n-th radio resource 3n. FIG. 4 is a flowchart for use in describing of operation of notification of a normal **load** state as the n-th **load** condition of the n-th **call processing** execution **processor** 2n. FIG. 5 is a flowchart for use in describing of operation of notification of an overload state as the n-th **load** condition of the n-th **call processing** execution **processor** 2n. FIG. 6 is a flowchart for use in describing of operation of determining of a **call** control **processor**. In addition, each of the first through the N-th **call processing** execution **processors** 21 to 2N has an overload threshold value and an overload release threshold value while the selection **processing** execution **processor** 10 has a reception permissible initial value.

Detailed Description Text - DETX (6):

Referring now to FIG. 3, the description will first proceed to operation on

notification of the n-th use condition of the n-th radio resource 3n. FIG. 3 illustrates operation of delivering the n-th use condition signal indicative of the n-th use condition of the n-th radio resource from the n-th **call processing** execution **processor** 2n to the selection **processing** execution **processor** 10. The n-th use condition indicates one of a free or enable condition and a disable condition.

Detailed Description Text - DETX (7):

The n-th **call processing** execution **processor** 2n periodically delivers, to the selection **processing** execution **processor** 10, the n-th use condition signal indicative of the n-th use condition of the n-th radio resource 3n accommodated by the n-th **call processing** execution **processor** 2n. The selection **processing** execution **processor** 10 stores the n-th use condition of the n-th radio resource 3n for the n-th **call processing** execution **processor** 2n in the use condition storing area 121 of the memory section 120 at a step S21.

Detailed Description Text - DETX (8):

Referring to FIG. 4, the description will proceed to operation of notification of the normal **load** state on normal **load**. It will be assumed in the n-th **call processing** execution **processor** 2n that the **processor load** state is a normal **load** state or is less than the overload threshold value at a step S31. In this event, the n-th **call processing** execution **processor** 2n periodically delivers the n-th **load** condition signal indicative of the normal **load** state to the selection **processing** execution **processor** 10. Responsive to the n-th **load** condition signal indicative of the normal **load** state, the selection **processing** execution **processor** 10 increments the n-th **call** reception permissible number within a predetermined range at a step S32.

Detailed Description Text - DETX (9):

Referring to FIG. 5, the description will proceed to operation of notification of the overload state on overload. It will be presumed in the n-th **call processing** execution **processor** 2n that the **processor load** state exceeds the overload threshold value at a step S41. Under the circumstances, the n-th **call processing** execution **processor** 2n periodically delivers the n-th **load** condition signal indicative of the overload state to the selection **processing** execution **processor** 10. Responsive to the n-th **load** condition signal indicative of the overload state, the selection **processing** execution **processor** 10 drastically decrements the n-th **call** reception permissible number in a case where the n-th **load** condition signal indicative of the overload state is a state transition from the normal **load** state to the overload at a step S42. Thereafter, responsive to the n-th **load** condition signal indicative of the overload state, the selection **processing** execution **processor** 10 decrements the n-th **call** reception permissible number by a little at a step S43.

Detailed Description Text - DETX (10):

Referring to FIG. 6, the description will proceed to operation of determining of the **call** control **processor**. FIG. 6 illustrates operation of determining of the **call** control **processor** in the selection **processing** execution **processor** 10.

Detailed Description Text - DETX (11):

When a **call** control request is made to the selection **processing** execution

processor 10, the selection processing execution processor 10 provisionally determines, as a current provisional determined call processing execution processor, the next call processing execution processor succeeded by the last distributed call processing execution processor at a step S51. The step S51 is followed by a step S52 at which the selection processing execution processor 10 determines whether or not all of the first through the N-th call processing execution processors 21 to 2N are retrieved. In as much as all of the first through the N-th call processing execution processors 21 to 2N are not retrieve in this time instant, the step S52 proceeds to a step S53 at which the selection processing execution processor 10 determines whether or not the radio resource of the current provisional determined call processing execution processor is available or enable. When the radio resource of the current provisional determined call processing execution processor is available or enable, the step S53 is succeeded by a step S54 at which the selection processing execution processor 10 determines whether or not the,current provisional determined call processing execution processor has the call reception permissible number which is not less than one.

Detailed Description Text - DETX (12):

When the call reception permissible number of the current provisional determined call processing execution processor is not less than one, the step S54 is followed by steps S55 and S56 at which the selection processing execution processor 10 decrements the call reception permissible number of the current provisional determined call processing execution processor by one and determines the current provisional determined call processing execution processor as a truly determined call processing execution processor.

Detailed Description Text - DETX (13):

When the radio resource of the current provisional determined call processing execution processor is disable or when the call reception permissible number of the current provisional determined call processing execution processor is zero, each of the steps S53 and S54 is succeeded by a step S57 at which the selection processing execution processor 10 retrieves the next provisional determined call processing execution processor which follows the current provisional determined call processing execution processor. The selection processing execution processor 10 turns a processing from the step S57 back to the step S52. That is, a similar check processing is made as regards to the next provisional determined call processing execution processor.

Detailed Description Text - DETX (14):

When all of the first through the N-th call processing execution processor 21 to 2N are retrieved, the step S52 proceeds to a step S58 at which the selection processing execution processor 10 does not carry out a call distribution.

Detailed Description Text - DETX (15):

In the manner which is described above, a retrieval processing is carried out until an available processor is determined.

Detailed Description Text - DETX (16):

As described above, according to this invention, the radio exchanging station 01 carries out the call distribution processing by determining the

first through the N-th load conditions of the first through the N-th call processing execution processors 21 to 2N and the first through the N-th use conditions of the first through the N-th radio resources 31 to 3N. As a result, it is possible to relax congestion of traffic and to realize the system having superior stability.

Detailed Description Text - DETX (17):

While this invention has thus far been described in conjunction with the preferred embodiment thereof, it will now be readily possible for those skilled in the art to put this invention into various other manners. For example, the radio exchanging station may comprise only one call processing execution processor although the radio exchanging station according to the above-mentioned embodiment comprises a plurality of call processing execution processors.

Claims Text - CLTX (1):

1. A method of distributing calls in a radio exchanging station for use in a mobile communication system, said radio exchanging station comprising a selection processing execution processor and first through N-th call processing execution processors, where N represents a positive integer which is not less than two, said method comprising the steps of: periodically delivering, from an n-th call processing execution processor to said selection processing execution processor, an n-th use condition signal indicative of an n-th use condition of an n-th radio resource managed by said n-th call processing execution processor and an n-th load condition signal indicative of an n-th load condition of said n-th call processing execution processor, where n represents each of 1 through N; and determining, in said selection processing execution processor, on the basis of first through N-th use conditions and first through N-th load conditions, first through N-th call reception permissible numbers for distributing to said first through said N-th call processing execution processors, respectively.

Claims Text - CLTX (2):

2. A method as claimed in claim 1, wherein said n-th call processing execution processor compares the n-th load condition of said n-th call processing execution processor with a predetermined overload threshold value, said n-th call processing execution processor sending the n-th load condition signal indicative of a normal load state to said selection processing execution processor when the n-th load condition of said n-th call processing execution processor is not more than the predetermined overload threshold value.

Claims Text - CLTX (3):

3. A method as claimed in claim 2, wherein said selection processing execution processor increments an n-th call reception permissible number within a predetermined range in response to the n-th load condition signal indicative of the normal load state.

Claims Text - CLTX (4):

4. A method as claimed in claim 1, wherein said n-th call processing execution processor compares the n-th load condition of said n-th call processing execution processor with a predetermined overload threshold value, said n-th call processing execution processor sending the n-th load condition

signal indicative of an overload state to said selection **processing** execution **processor** when the n-th **load** condition of said n-th **call processing** execution **processor** exceeds the predetermined overload threshold value.

Claims Text - CLTX (5):
5. A method as claimed in claim 4, wherein said selection **processing** execution **processor** decrements an n-th **call** reception permissible number in response to the n-th **load** condition signal indicative of the overload state.

Claims Text - CLTX (6):
6. A method as claimed in claim 5, wherein said selection **processing** execution **processor** drastically decrements the n-th **call** reception permissible number in response to the n-th **load** condition signal indicative of the overload state which is a state transition from the normal **load** state to the overload state, thereafter, the selection **processing** execution **processor** 10 decrements, in response to the n-th **load** condition signal indicative of the overload state, the n-th **call** reception permissible number by a little.

Claims Text - CLTX (7):
7. A method as claimed in claim 1, wherein said selection **processing** execution **processor** provisionally determines, in response to a **call** control request, the next **call processing** execution **processor** succeeded by the last **distributed call processing** execution **processor** as a current provisional determined **call processing** execution **processor**.

Claims Text - CLTX (8):
8. A method as claimed in claim 7, wherein when the radio resource of the current provisional determined **call processing** execution **processor** is enable and when the current provisional determined **call processing** execution **processor has the call** reception permissible number which is not less than one, said selection **processing** execution **processor** determines the current provisional determined **call processing** execution **processor** as a truly determined **call processing** execution **processor**.

Claims Text - CLTX (9):
9. A method as claimed in claim 7, wherein when the radio resource of the current provisional determined **call processing** execution **processor** is disable or when the current provisional determined **call processing** execution **processor has the call** reception permissible number of zero, said selection **processing** execution **processor** retrieves the next provisional determined **call processing** execution **processor** which follows the current provisional determined **call processing** execution **processor**.

Claims Text - CLTX (10):
10. A method of **distributing calls** in a radio exchanging station for use in a **mobile** communication system, said radio exchanging station comprising a selection **processing** execution **processor and a call processing** execution **processor,** said method comprising the steps of: periodically delivering, from said **call processing** execution **processor** to said selection **processing** execution **processor,** a use condition signal indicative of a use condition of a radio resource managed by said **call processing** execution **processor and a load**

condition signal indicative of a load condition of said call processing execution processor, and determining, in said selection processing execution processor, on the basis of said use condition and said load condition, a call reception permissible number for distributing to said call processing execution processor.

Claims Text - CLTX (11):
11. A method as claimed in claim 10, wherein said call processing execution processor compares the load condition of said call processing execution processor with a predetermined overload threshold value, said call processing execution processor sending the load condition signal indicative of a normal load state to said selection processing execution processor when the load condition of said call processing execution processor is not more than the predetermined overload threshold value.

Claims Text - CLTX (12):
12. A method as claimed in claim 11, wherein said selection processing execution processor increments a call reception permissible number within a predetermined range in response to the load condition signal indicative of the normal load state.

Claims Text - CLTX (13):
13. A method as claimed in claim 10, wherein said call processing execution processor compares the load condition of said call processing execution processor with a predetermined overload threshold value, said call processing execution processor sending the load condition signal indicative of an overload state to said selection processing execution processor when the load condition of said call processing execution processor exceeds the predetermined overload threshold value.

Claims Text - CLTX (14):
14. A method as claimed in claim 13, wherein said selection processing execution processor decrements a call reception permissible number in response to the load condition signal indicative of the overload state.

Claims Text - CLTX (15):
15. A method as claimed in claim 14, wherein said selection processing execution processor drastically decrements the call reception permissible number in response to the load condition signal indicative of the overload state which is a state transition from the normal load state to the overload state, thereafter, the selection processing execution processor decrements, in response to the load condition signal indicative of the overload state, the call reception permissible number by a little.